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Normal viscous force of pendular liquid bridge between two relatively moving particles

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Abstract

In this work, Direct Numerical Simulations (DNS) of a pendular liquid bridge formed between two relatively moving particles are performed to evaluate the normal component of the viscous force exerted on the particles. The viscous force obtained are non-dimensionalised in order to clarify the parameters which can affect the dimensionless force. The DNS results are compared with the viscous force models in literature which are commonly used in DEM simulations. It is found that these models cannot be used with large inter-particle separation distance. A new and more accurate viscous force model is proposed from the DNS results which can be directly implemented in the DEM framework.

Keywords:

Pendular liquid bridge, Normal viscous force, DNS, DEM

1. Introduction

In many powder handling processes, liquid is frequently added to dry and fine powder. Typical examples include wet granulation and powder coating. In these processes, the liquid added is dispersed among powder and forms liquid bridges between particles which lead the liquid bridge forces exerted on the particles. When relatively low amount of liquid is used compared to the volume of powder, pendular liquid bridges can be observed as shown in Figure 1, i.e. one bridge formed between a pair of particles. The liquid

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